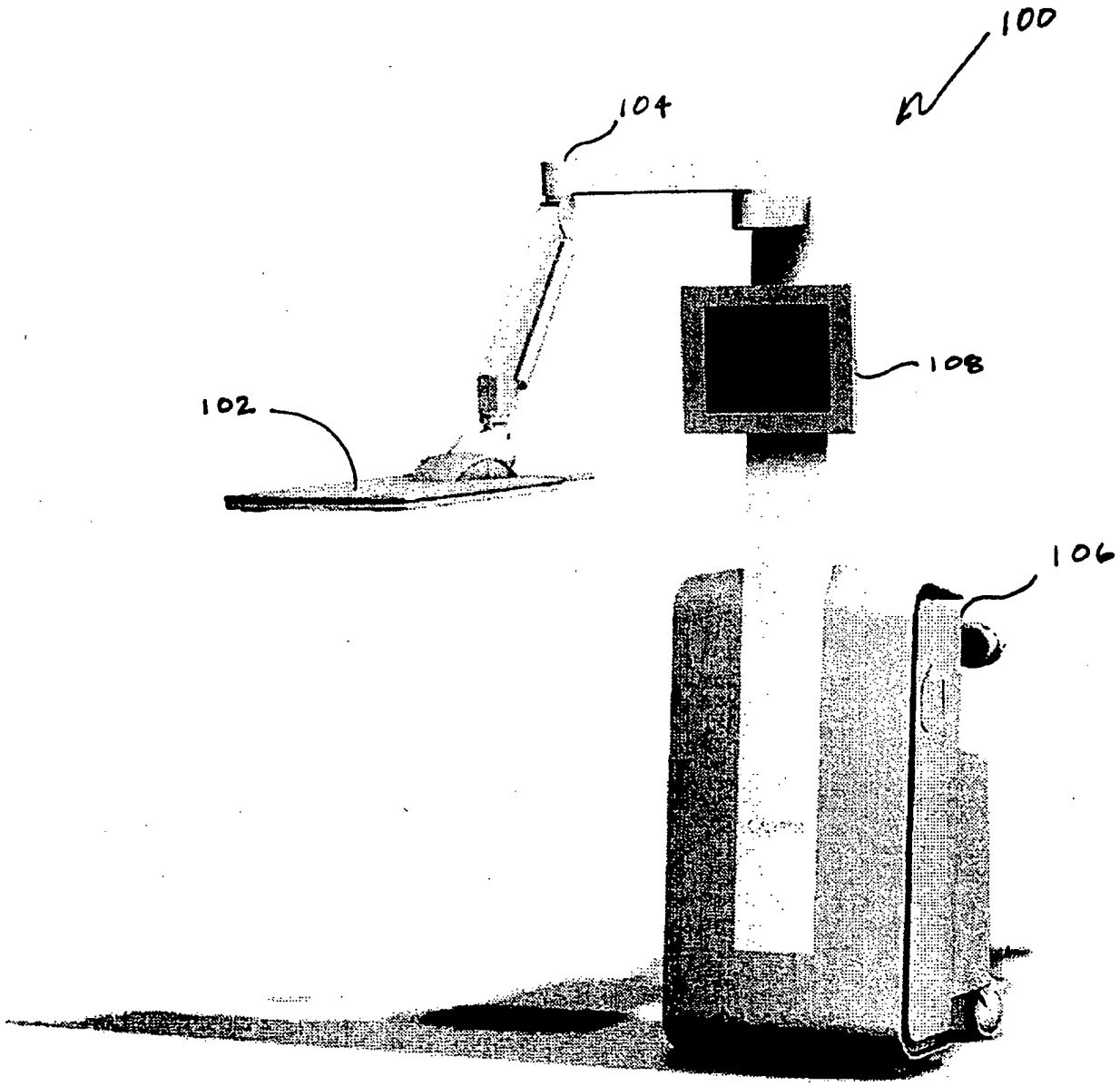
FIG. 1



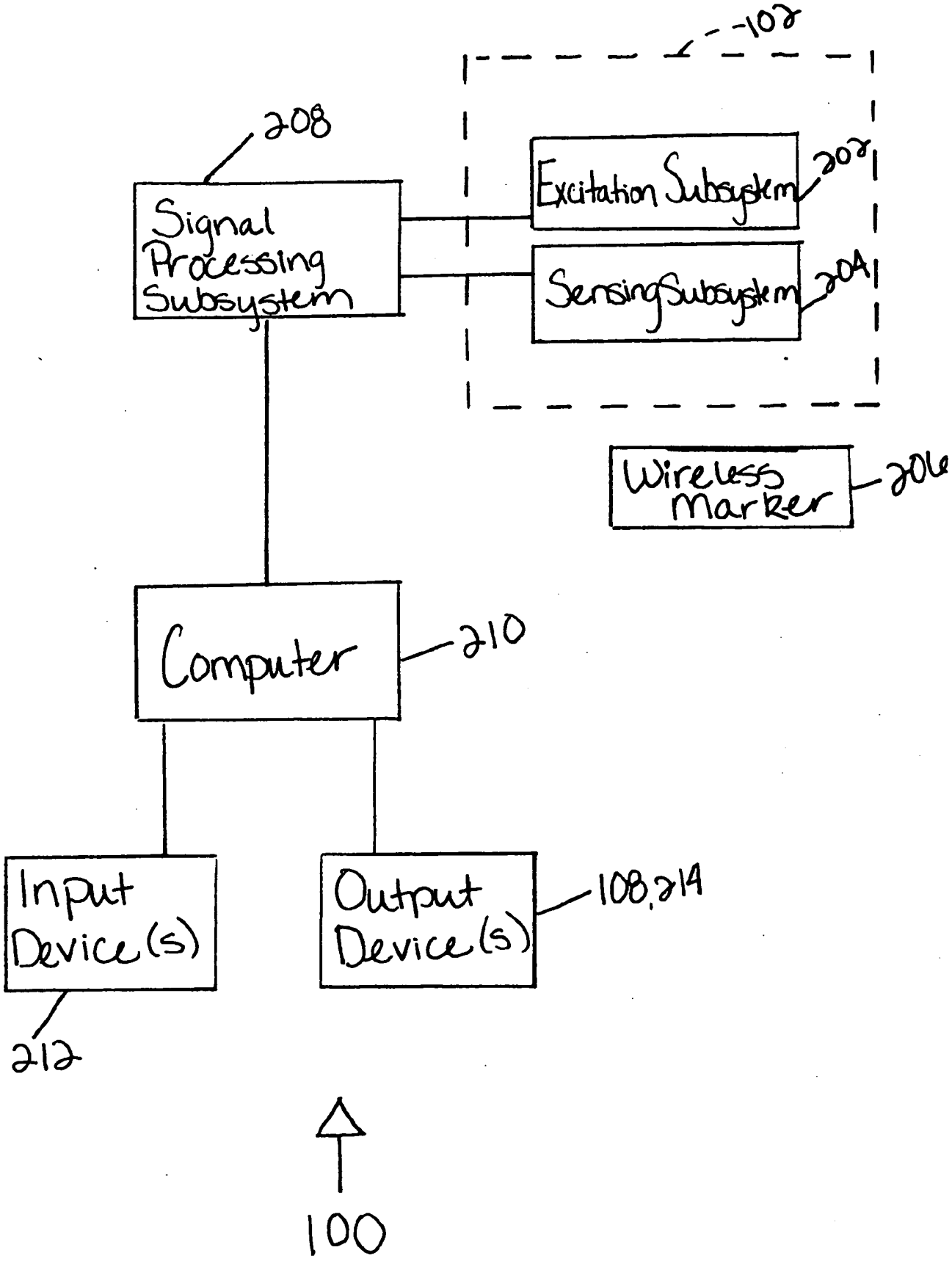

102
208
Signal Processing Subsystem
Excitation Subsystem
202
Sensing Subsystem
204
Wireless Marker
206
Computer
210
Input Device(s)
212
Output Device(s)
108, 214
100

Figure 2

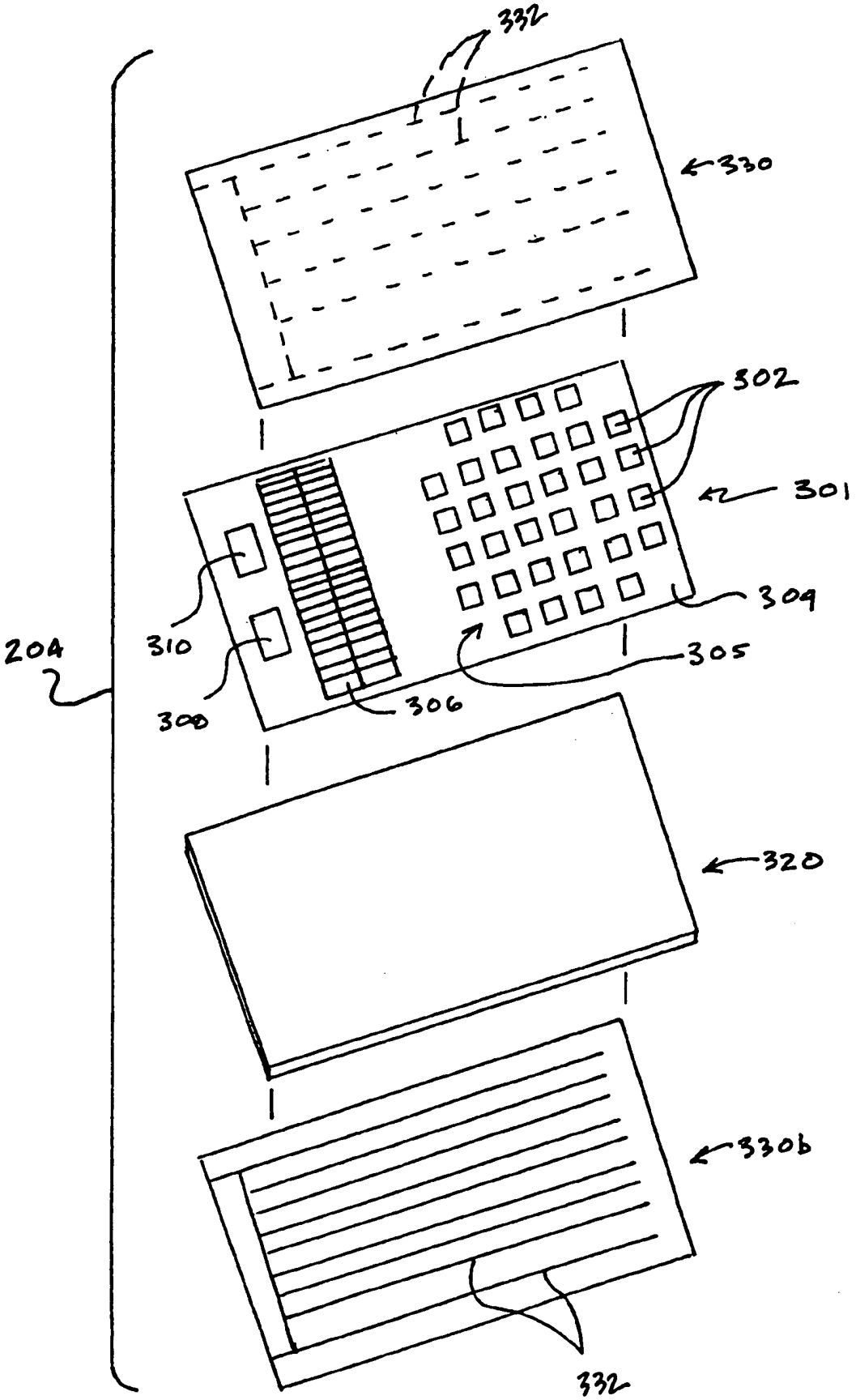


Fig.- 3A

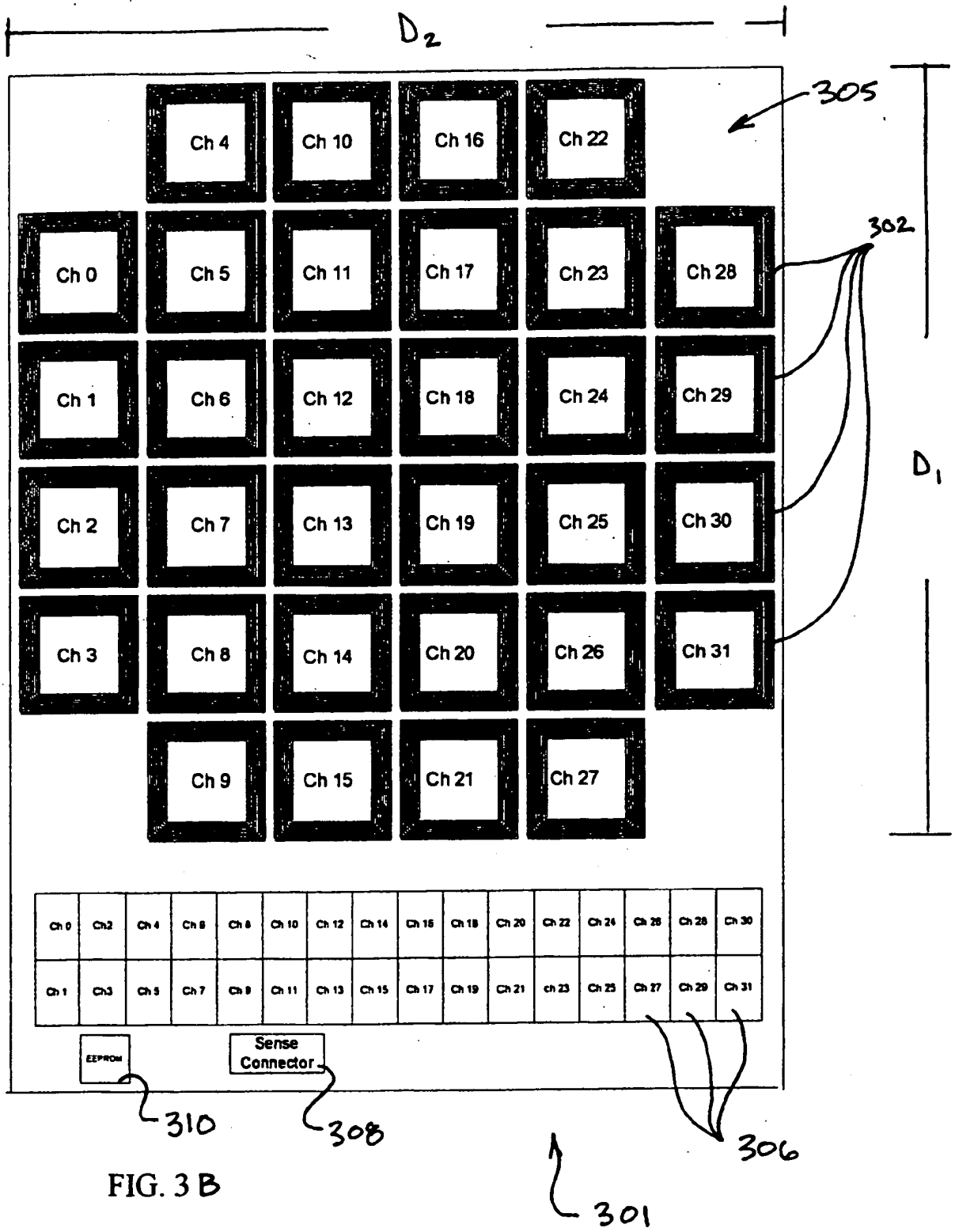

D2
305
Ch 4
Ch 10
Ch 16
Ch 22
Ch 0
Ch 5
Ch 11
Ch 17
Ch 23
Ch 28
302
Ch 1
Ch 6
Ch 12
Ch 18
Ch 24
Ch 29
D1
Ch 2
Ch 7
Ch 13
Ch 19
Ch 25
Ch 30
Ch 3
Ch 8
Ch 14
Ch 20
Ch 26
Ch 31
Ch 9
Ch 15
Ch 21
Ch 27
Ch 0 Ch2 Ch 4 Ch 6 Ch 8 Ch 10 Ch 12 Ch 14 Ch 16 Ch 18 Ch 20 Ch 22 Ch 24 Ch 26 Ch 28 Ch 30
Ch 1 Ch3 Ch 5 Ch 7 Ch 9 Ch 11 Ch 13 Ch 15 Ch 17 Ch 19 Ch 21 ch 23 Ch 25 Ch 27 Ch 29 Ch 31
EEPROM
Sense Connector
310
308
306
301

FIG. 3 B

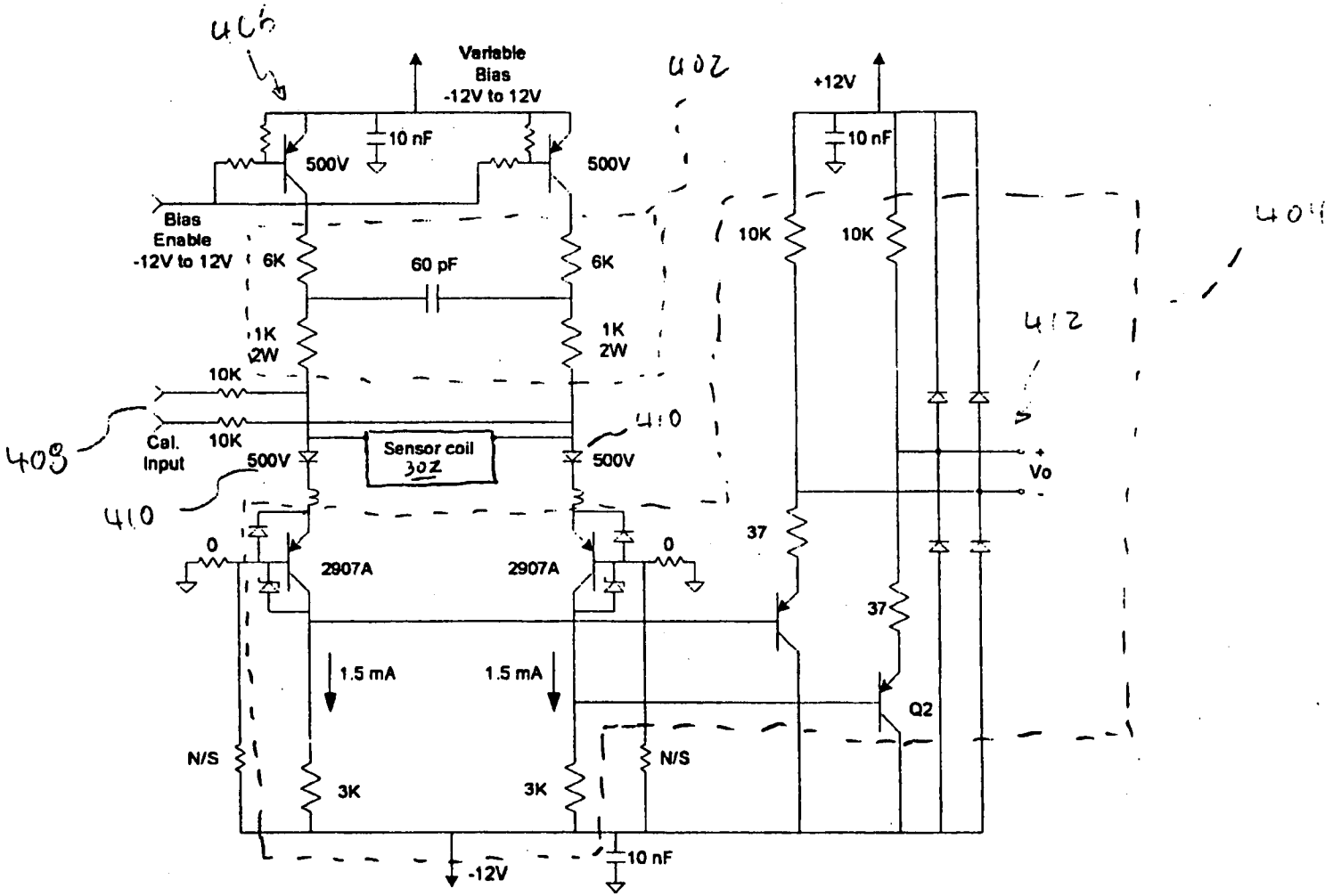

406
Variable
Bias
-12V to 12V
402
+12V
10 nF
500V
500V
10 nF
404
Bias
Enable
-12V to 12V
6K
60 pF
6K
10K
10K
412
1K
2W
1K
2W
10K
408
Cal.
Input
10K
410
Sensor coil
302
500V
500V
Vo
410
37
0
2907A
2907A
0
37
1.5 mA
1.5 mA
Q2
N/S
3K
3K
N/S
10 nF
-12V

FIG. 4

400

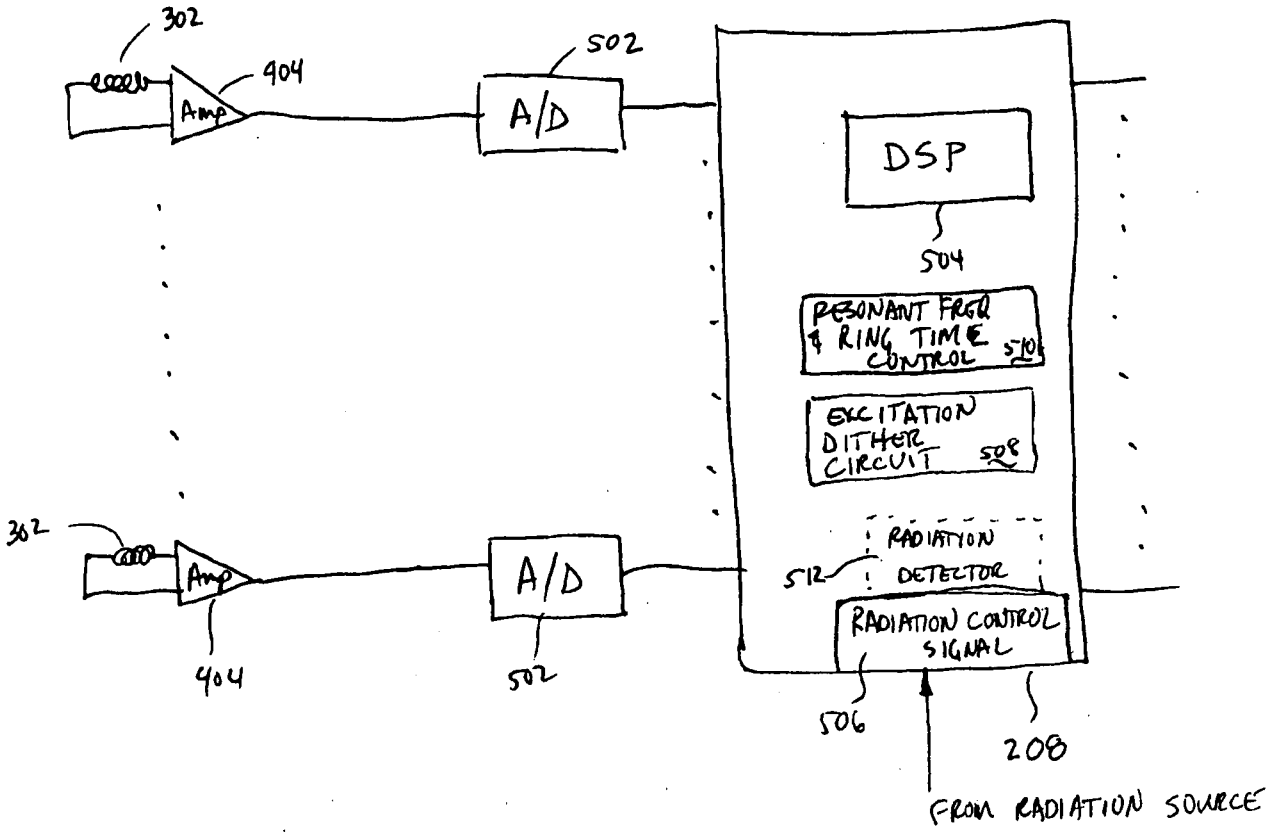

302
404
Amp
A/D
502
DSP
504
RESONANT FREQ & RING TIME CONTROL
510
EXCITATION DITHER CIRCUIT
508
RADIATION DETECTOR
512
RADIATION CONTROL SIGNAL
506
208
FROM RADIATION SOURCE

Figure 5

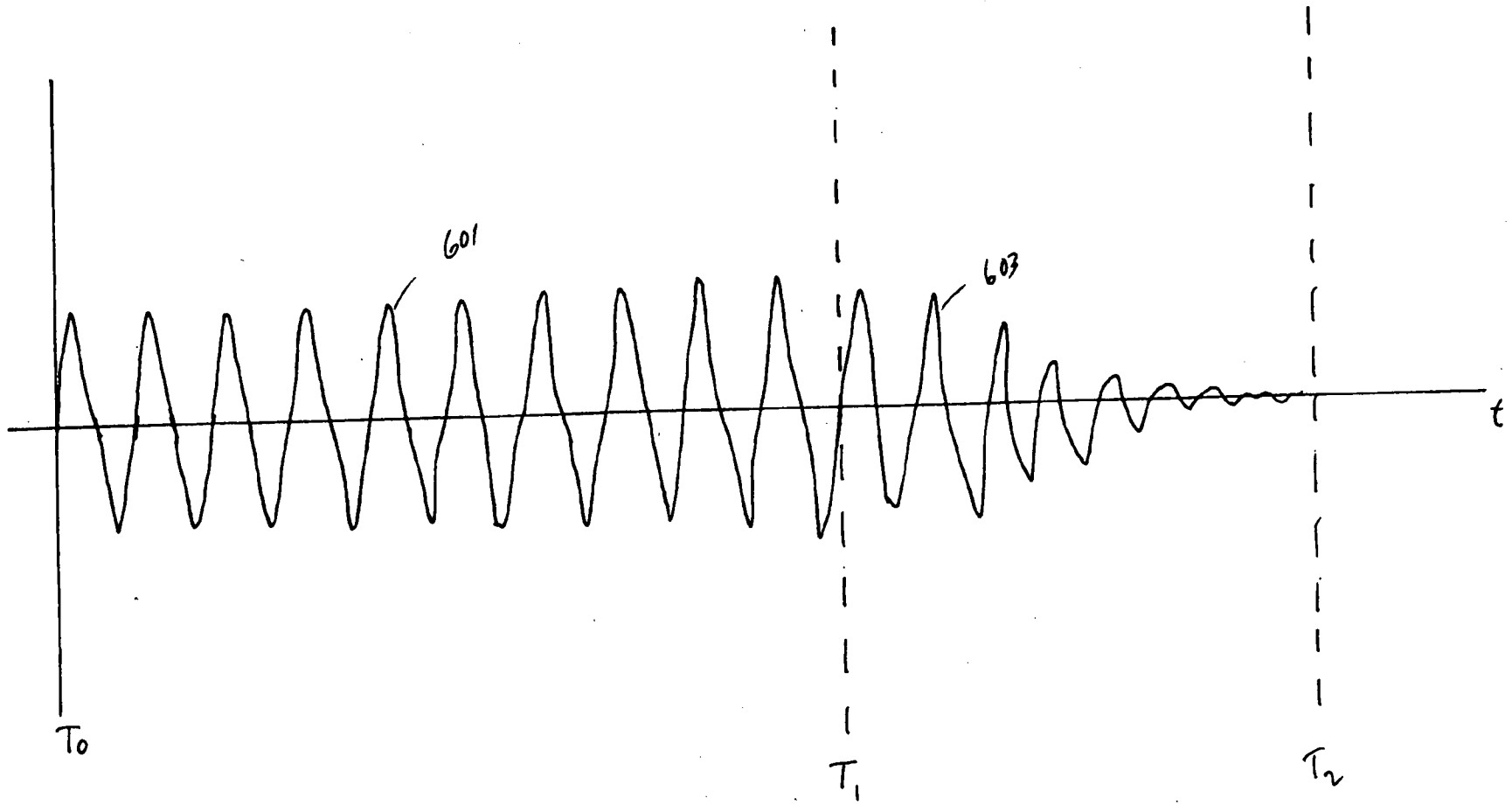


Figure 6

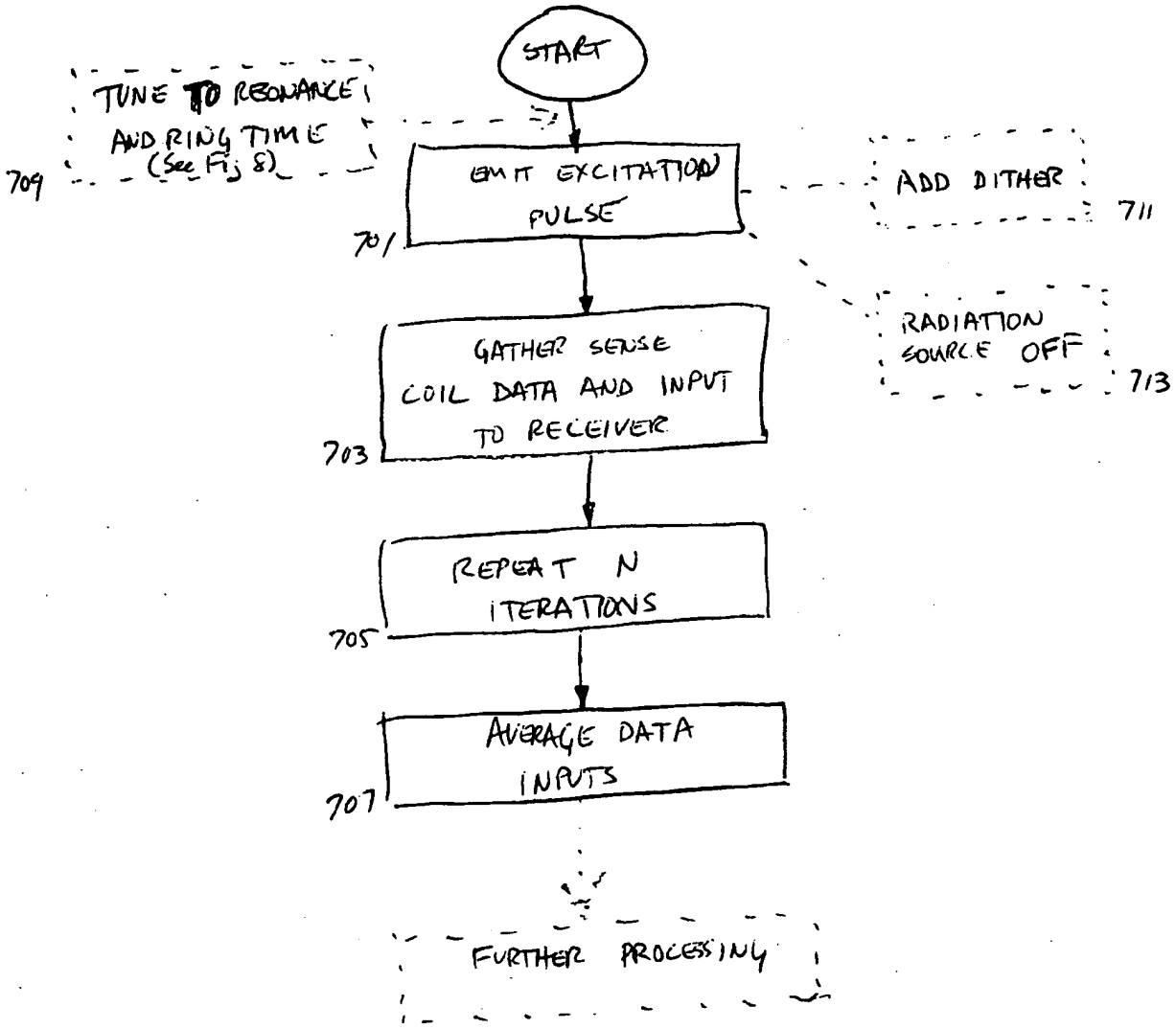

START
TUNE TO RESONANCE AND RING TIME (See Fig 8)
709
EMIT EXCITATION PULSE
701
ADD DITHER
711
RADIATION SOURCE OFF
713
GATHER SENSE COIL DATA AND INPUT TO RECEIVER
703
REPEAT N ITERATIONS
705
AVERAGE DATA INPUTS
707
FURTHER PROCESSING

Figure 7

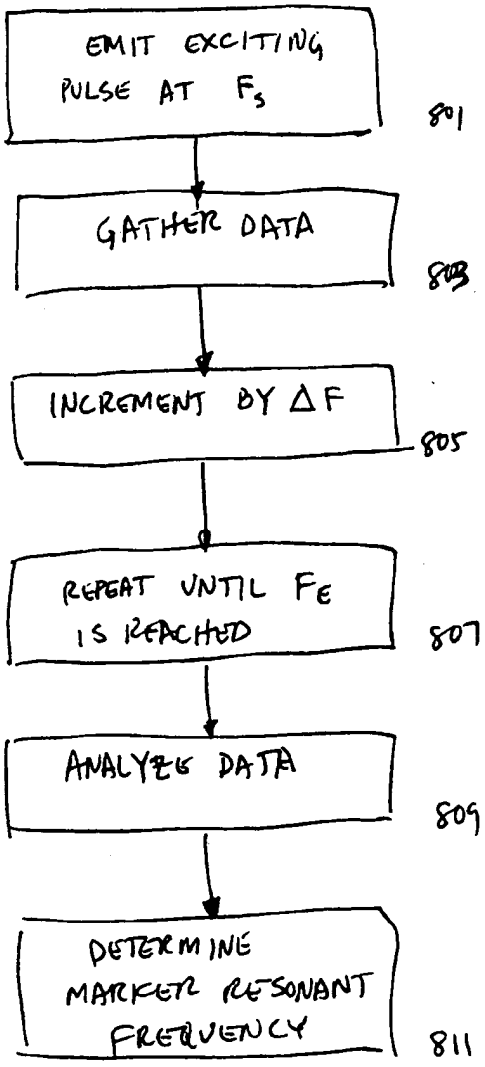

EMIT EXCITING PULSE AT F_s
801
GATHER DATA
803
INCREMENT BY ΔF
805
REPEAT UNTIL F_E IS REACHED
807
ANALYZE DATA
809
DETERMINE MARKER RESONANT FREQUENCY
811

Figure 8

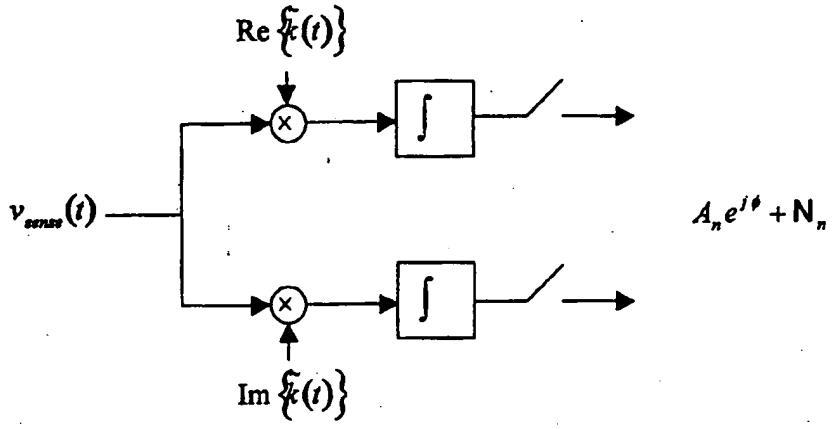


Fig 9

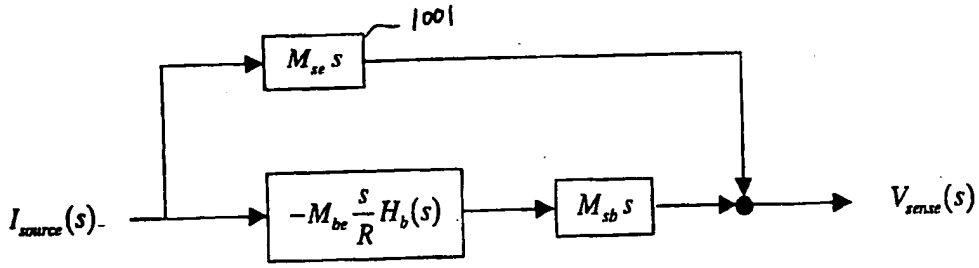

1001
$M_{se}s$
$I_{source}(s)$
$-M_{be}\frac{s}{R}H_b(s)$
$M_{sb}s$
$V_{sense}(s)$

Fig 10

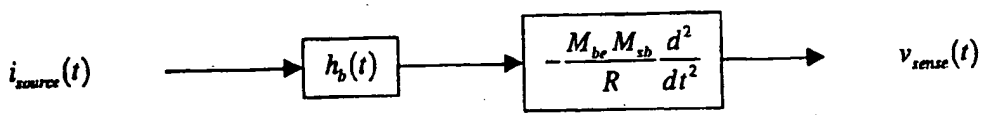

$i_{source}(t)$
$h_b(t)$
$-\frac{M_{be}M_{sb}}{R}\frac{d^2}{dt^2}$
$v_{sense}(t)$

Fig 11

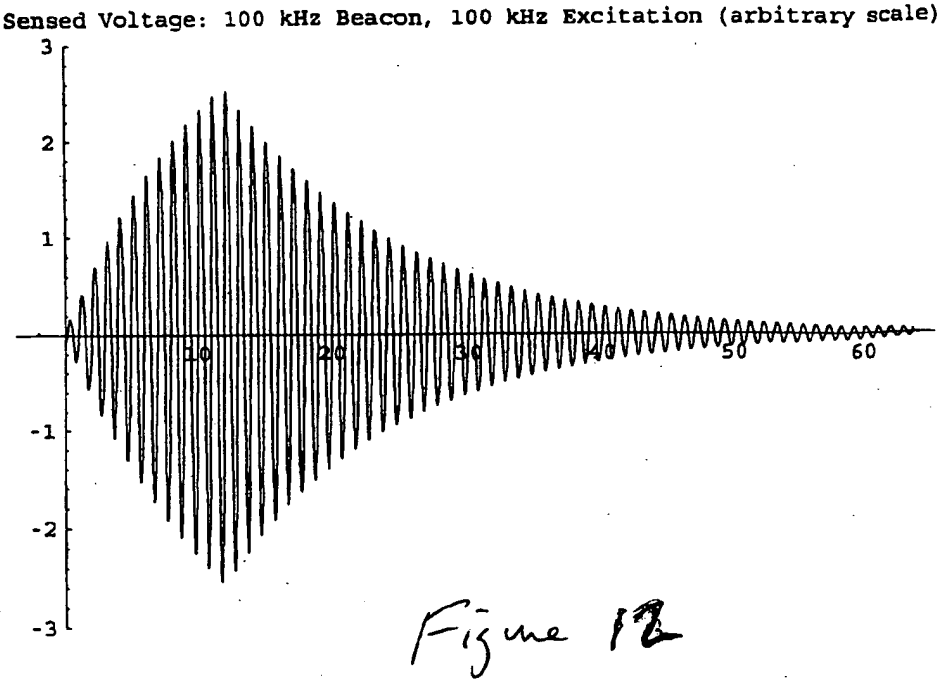


Figure 12

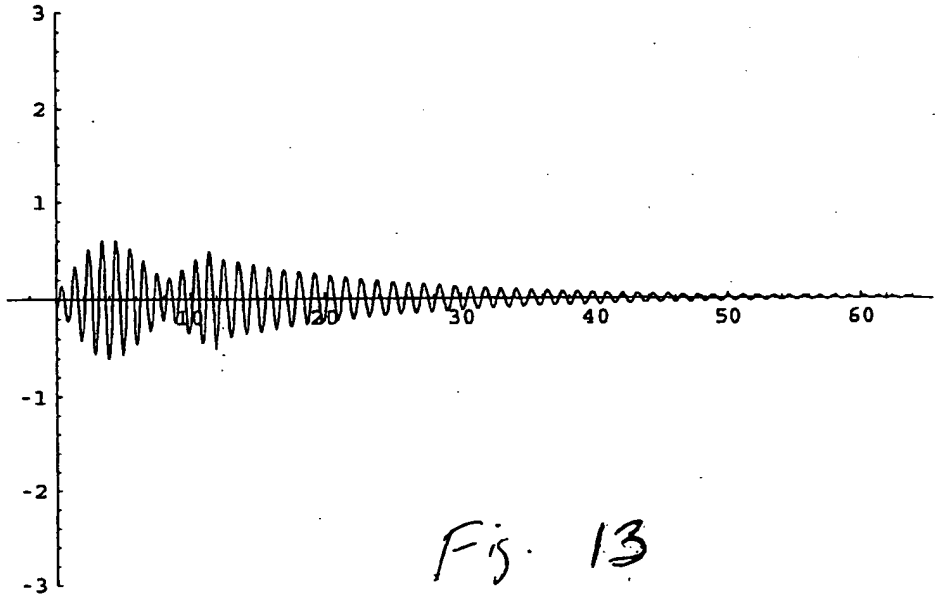


Fig. 13

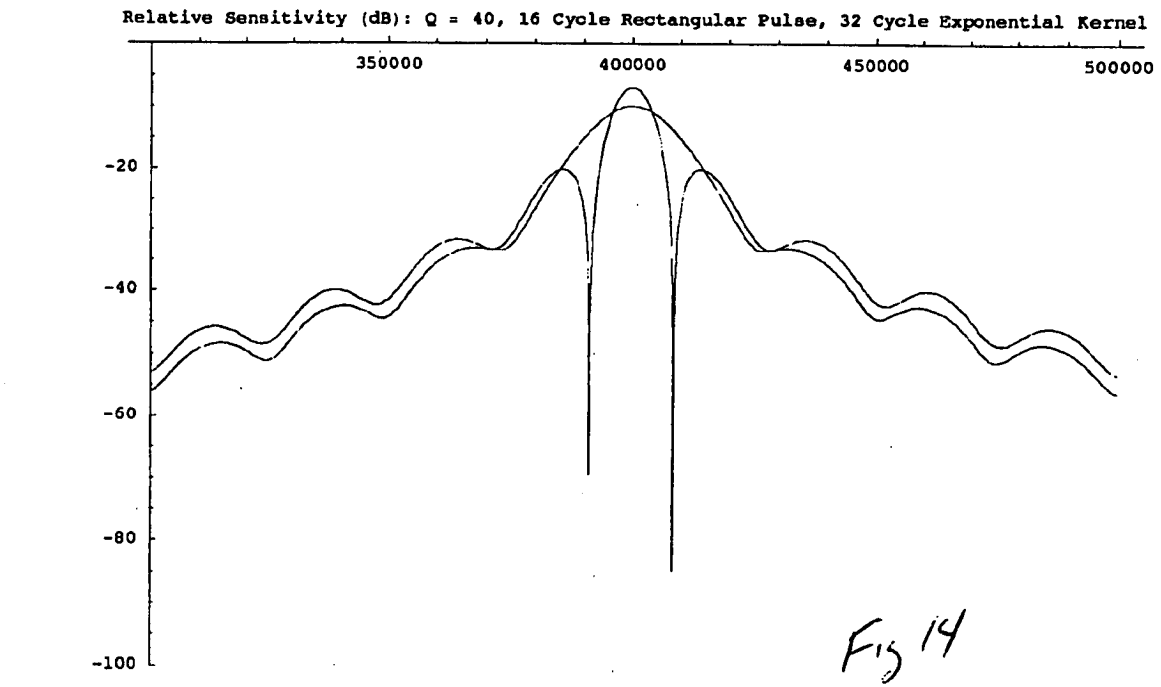


Fig 14

- Graphics -

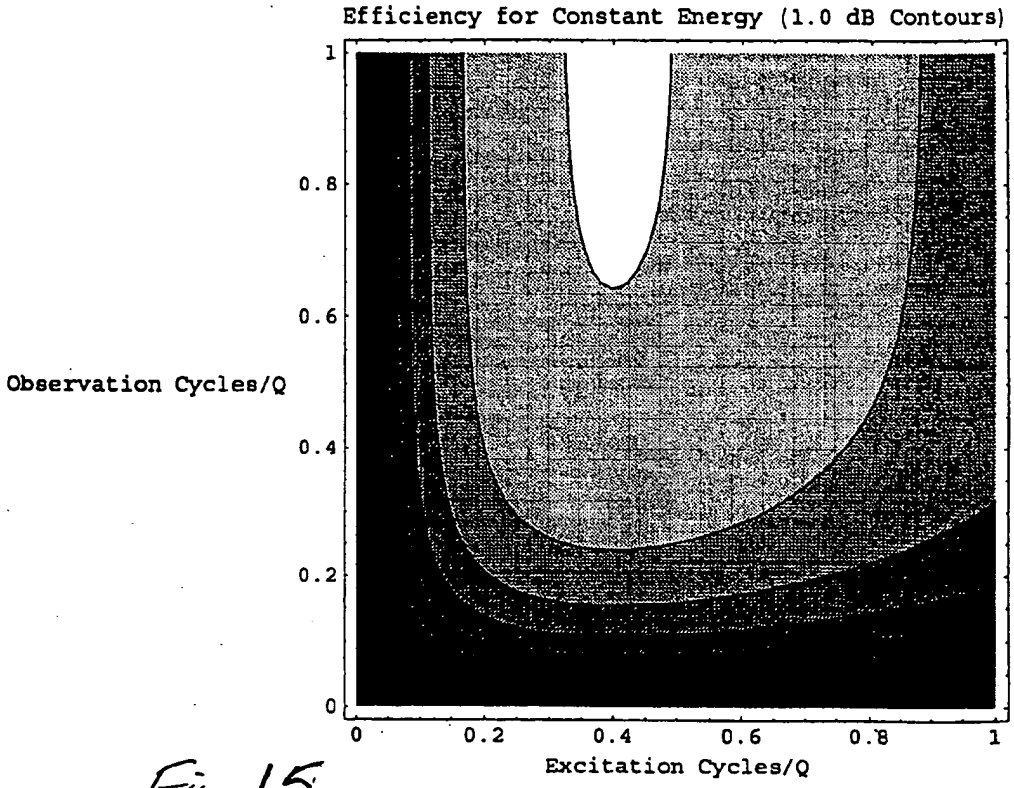

Efficiency for Constant Energy (1.0 dB Contours)
Observation Cycles/Q
Excitation Cycles/Q
0
0.2
0.4
0.6
0.8
1

Fig 15

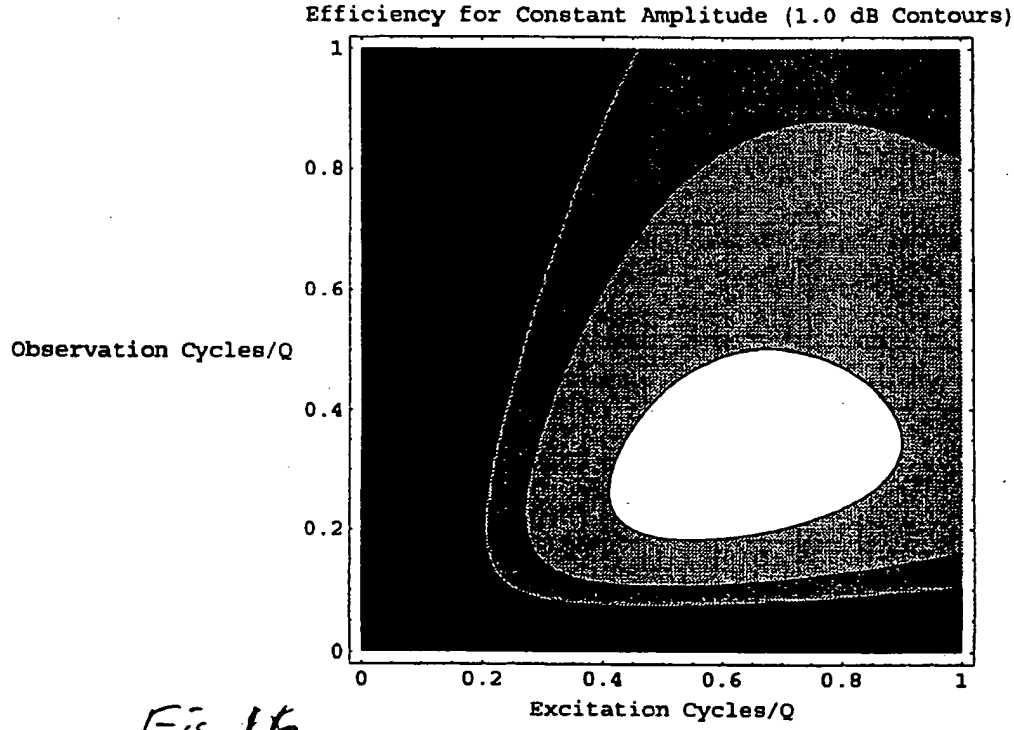

Efficiency for Constant Amplitude (1.0 dB Contours)
Observation Cycles/Q
Excitation Cycles/Q
0
0.2
0.4
0.6
0.8
1

Fig 16

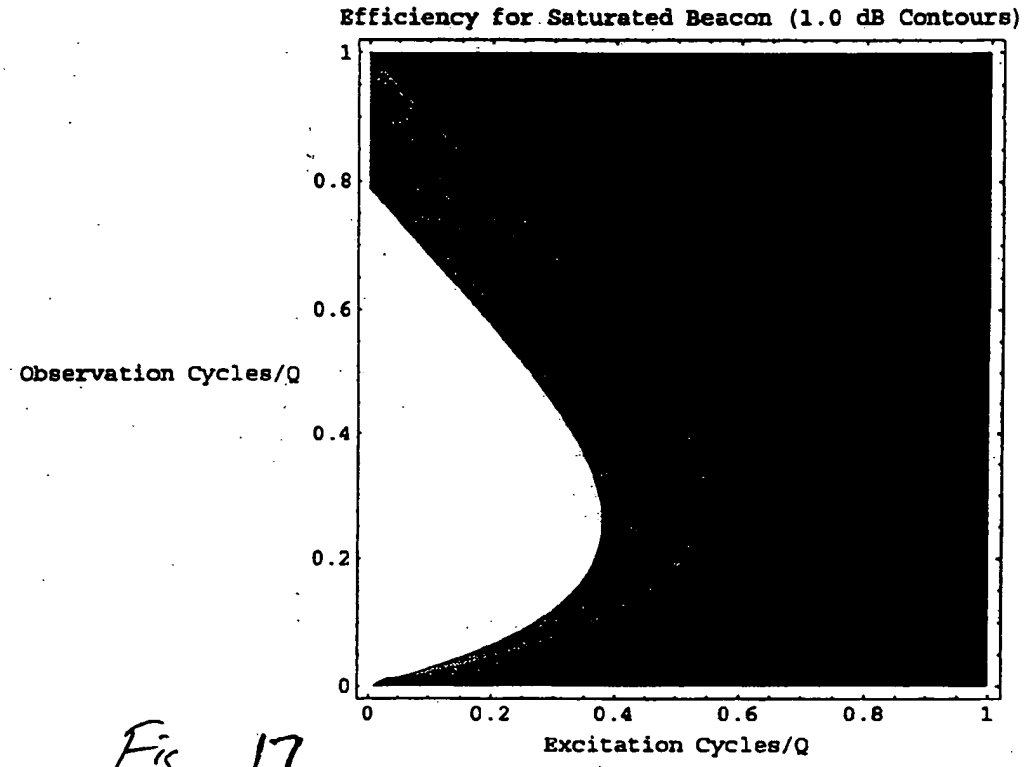

Efficiency for Saturated Beacon (1.0 dB Contours)
Observation Cycles/Q
1
0.8
0.6
0.4
0.2
0
0
0.2
0.4
0.6
0.8
1
Excitation Cycles/Q

Fig 17

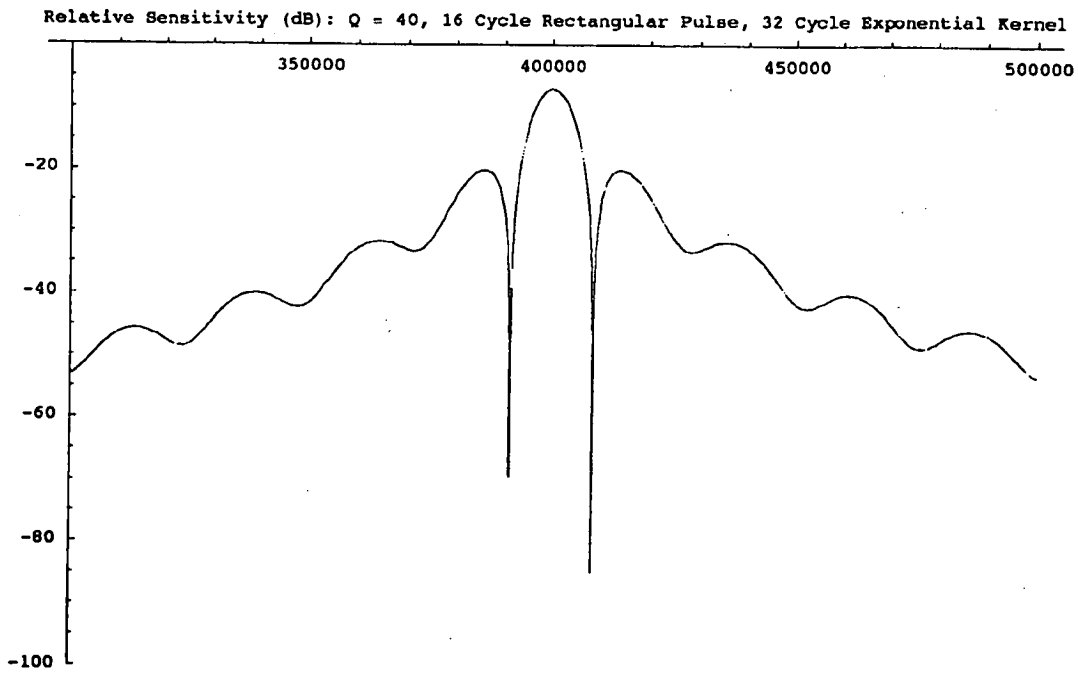

Relative Sensitivity (dB): Q = 40, 16 Cycle Rectangular Pulse, 32 Cycle Exponential Kernel
350000
400000
450000
500000
-20
-40
-60
-80
-100

Fig 18

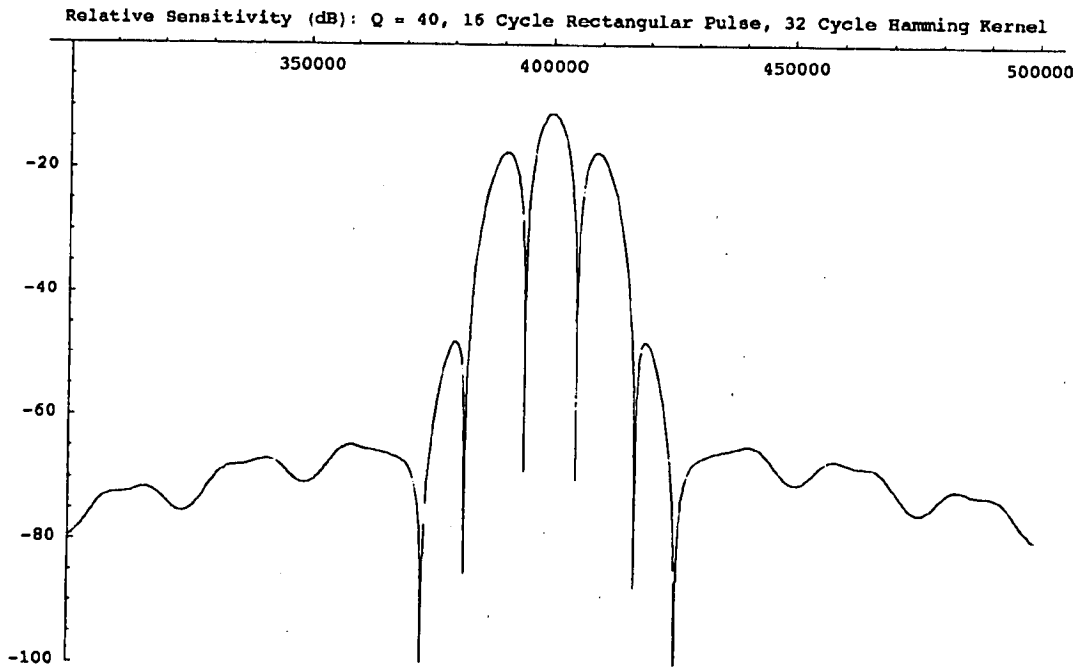

Relative Sensitivity (dB): Q = 40, 16 Cycle Rectangular Pulse, 32 Cycle Hamming Kernel
350000
400000
450000
500000
-20
-40
-60
-80
-100

Figure 19

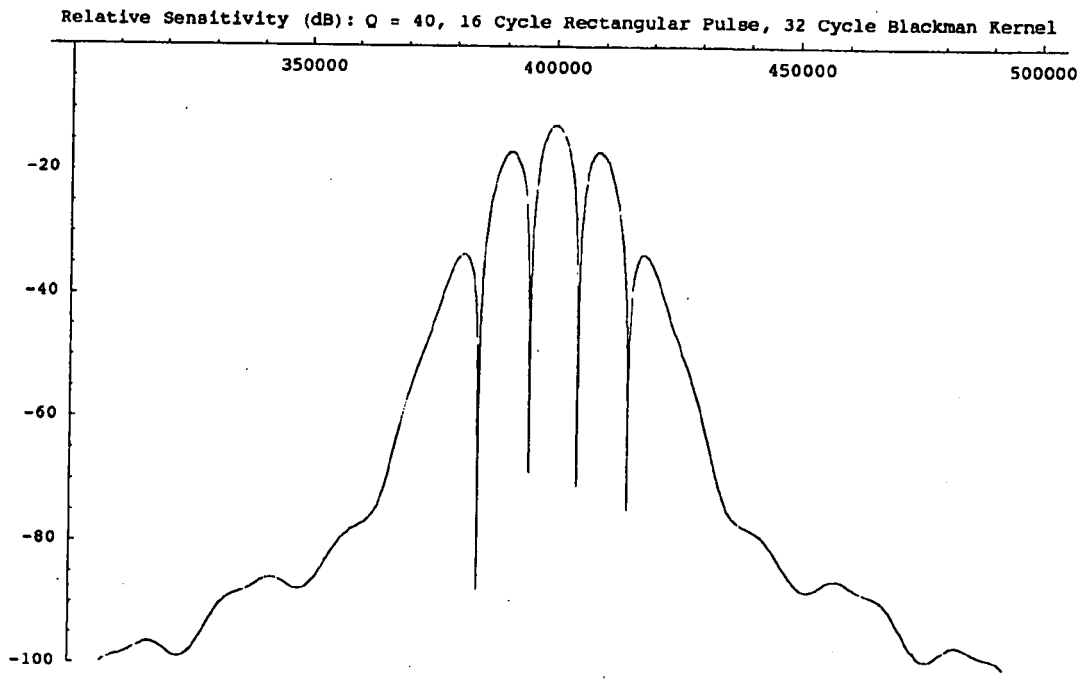

Relative Sensitivity (dB): Q = 40, 16 Cycle Rectangular Pulse, 32 Cycle Blackman Kernel
350000
400000
450000
500000
-20
-40
-60
-80
-100

Figure 20